

**RESULTS OF 1989 WILLAMETTE RIVER-BURLINGTON/NORTHERN  
R.R. BRIDGE SEDIMENT QUALITY EVALUATION****Abstract**

A sediment quality evaluation of shoal material at Willamette River Mile 7.0 (site of the Burlington/Northern Railroad swing bridge) was initiated with the collection of shoal material on July 19, 1989. Physical and chemical analyses were conducted. Based on the results of these tests and a review of previous evaluations, which included bioassays, no toxicological effect would be expected by the removal and unconfined in-water disposal of the existing shoal material.

**Project Description**

The Federally maintained Willamette River navigation project provides for a channel 40 feet deep and 600 to 2000 feet wide from river mile (RM) 0.0 at the Mouth of the Willamette River to RM 11.7 at the Broadway Bridge in Portland, Oregon. A Burlington/Northern Railroad Bridge crosses the Willamette River at RM 7.0. The existing swing bridge, whose center pivot bisects the navigation channel, was scheduled for removal during the summer of 1989. Riedel International was the prime contractor for the bridge removal project which included the removal of piling/deflection pier, pivot pier and bottom material within the area bounded by the piling/deflection pier to a 40 foot depth. Hydrosurveys dated 14 July 1989 performed by the USACE Portland District indicate shoaling of material above the 40 foot project depth in the immediate vicinity of the bridge pier. This material is outside of the dredging prism for the bridge removal project and will be removed by the government as part of its Willamette River navigation maintenance responsibilities.

**Previous Studies**

Sediment samples were collected from RM 2.0 to the Broadway Bridge at RM 11.7 as part of a 1988 Lower Willamette River sediment quality evaluation conducted by this office. Two samples 7.1L and 7.3L were collected along the west bank portion of the navigation channel at RM 7.1 and RM 7.3, respectively, using a gravity core sampler. Bulk chemistry, elutriate tests and bioassays were run on the individual samples. Along with samples taken at RM 4.3 and RM 5.1 these samples had the highest recorded heavy metals concentrations for all priority pollutants tested except for lead. They also contained the highest concentrations of most of the organic compounds found. Sample 7.1L showed significant mortality in the dissolved phase, while no mortality was noted in any solid phase tests. Mortality, it was felt, was due to high ammonia or depressed oxygen levels in the test containers. The highest ammonia release during elutriate testing was for sample 7.1L.

In summary these samples showed elevated levels for cadmium, copper, mercury, DDD, DDT, ammonia and total PAHs but showed no toxicological effect except as noted. However, it was recommended that sediments from RM 7.0 to RM 7.5 be placed in a confined in-water or upland site due to the elevated levels of DDD.

### Present Study

Sediment samples were collected on July 19, 1989 with a 2.5 inch vibracore using Riedel's barge mounted crane which was on site. Due to restrictions imposed by sampling under an active working swing bridge and the limit of the crane-barge anchoring system the shoal immediately up and downstream of the fender piles could not be sampled. However the shoal in the right channel adjacent to the fender piles and an area immediately downstream of the pivot pile for the railroad bridge was sampled (see attachment 1). Three cores were collected. These cores were transported in their acid-rinsed cellulose butyrate acetate core liners to the CENPD Lab for cold storage then subsequently logged and subsampling on July 20, 1989.

Each core was extruded from the core liner, split in half, logged and subsampled for physical and chemical testing. The chemical subsamples were placed in amber 500ml I-Chem Specialty Cleaned Containers with teflon lined lids. Based on the visual inspection cores WRBN-1 and WRBN-2 were divided into two sections each and tested separately. Sample WRBN-3 consisted predominately of sand-blasting sand from past painting projects of the railroad bridge. Samples of this core were taken for physical and heavy metal analysis only.

### Discussion

Physical data: Core WRBN-1 was 111 inches long. Based on physical characteristics the core was divided into two sections, one from 0.0 to 29 inches deep the other from 29 to 111 inches. WRBN-2 was similarly subdivided from 0.5 to 37.5 inches deep and 37.5 to 104 inches. WRBN-3 was 66 inches long and was not subdivided. For both WRBN-1 and WRBN-2, grain size increased with depth while volatile solids decreased. WRBN-3 appeared to consist of sand blasting sand except for the bottom 3 inches of material which consisted of a medium olive brown silt. As this material is not considered to be representative of the bulk of the shoal, the physical analysis for sample WRBN-3 was limited to grain size. See attachment 2 for data sheets.

Chemical data: For samples WRBN-1 and WRBN-2 the chemical analyses indicate metals, TOC and oil and grease concentrations are low and typical of uncontaminated river sediment. Pesticides, PCBs, PAHs, phthalates and phenols are below the method of detection limit except for traces of bis(2-thylhexyl) phthalate that is present at or near the detection limit in several samples (attachment 3). As WRBN-3 was not considered typical or representative of the major shoal material,

chemical analysis was therefore limited to heavy metals. Sand blasting sand is produced as a byproduct of silver mining and processing. This coupled with the possibility that lead, chromium and other heavy metals from paint chips could be present prompted the analysis for heavy metals. The levels for these constituents in sample WRBN-3 do not vary significantly from the other samples nor do they indicate any significant elevation in contamination above normal background levels.

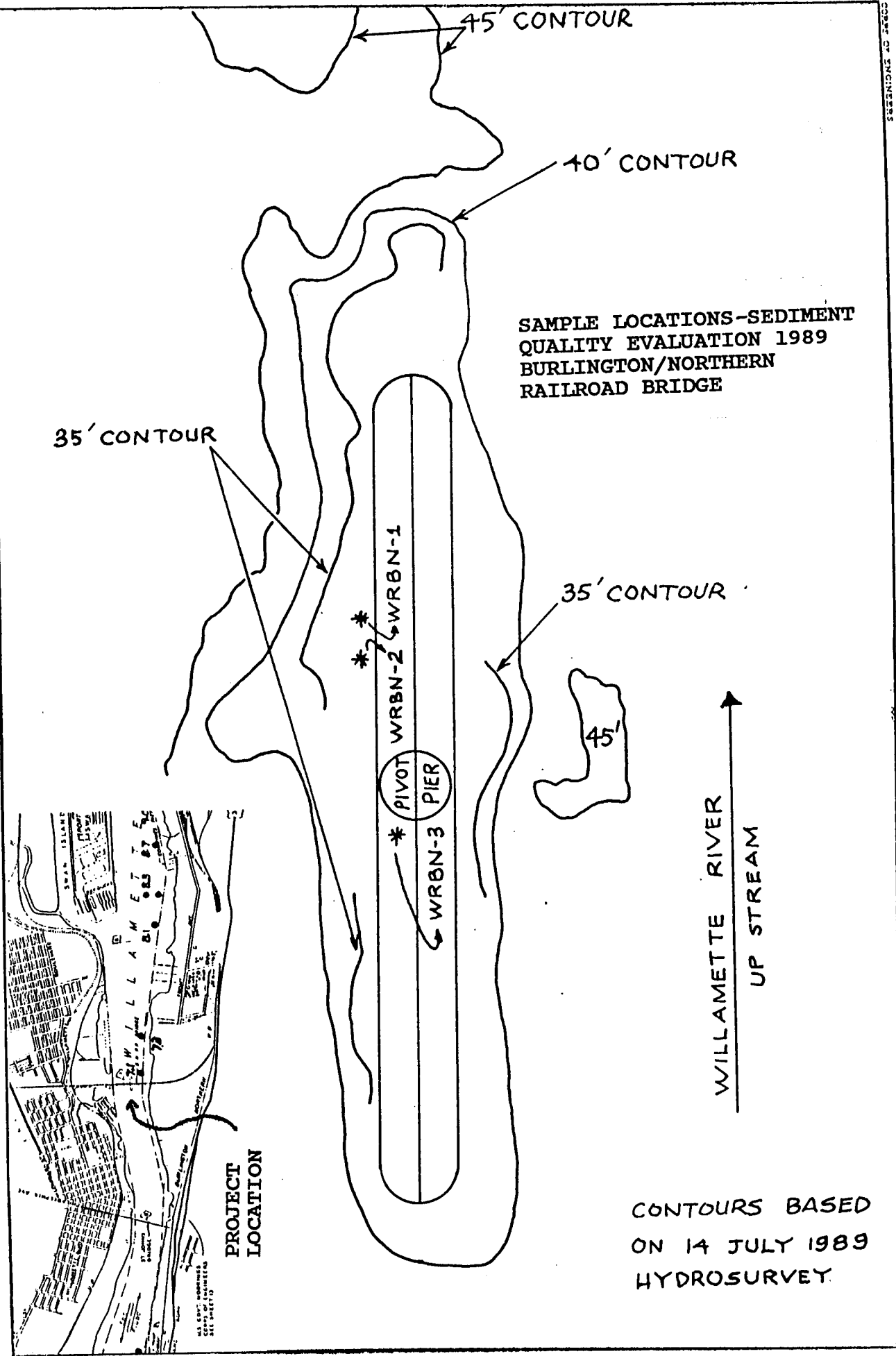
### Recommendations

The samples collected and analyzed are representative of the material present in the shoal sampled. Material comprising the shoals up and downstream of the fender piles for the swing bridge are believed to be similar in nature and composition. Based on these analyses and previous studies, the material is acceptable, from a toxicity standpoint, for unconfined in-water disposal. Acute or chronic toxicity/bioaccumulation effects from in-water disposal of these sediments would not be expected.

### Report Preparation

Sediment samples were collected and this sediment quality evaluation was prepared by Mr. Mark D. Siipola of the Coastal Flood Plain Management Branch, Planning Division, USACE Portland District. Analytical chemistry was performed under the direction of Dr. Eric Crecelius, Battelle's Pacific Division Northwest Marine Sciences Laboratory, Sequim, Washington. Physical analyses were performed by the CENPD Lab in Troutdale, Oregon under the direction of Mr. Tim Simmons.

ATTACHMENT 1



ATTACHMENT 2

SEEMAN/eat



DEPARTMENT OF THE ARMY  
NORTH PACIFIC DIVISION MATERIALS LABORATORY  
CORPS OF ENGINEERS  
1491 N.W. GRAHAM AVENUE  
TROUTDALE, OREGON 97060-9503

CENPD-EN-G-1. (1110-1-8100c)

14 Aug 89

MEMORANDUM FOR: Commander, Portland District, ATTN: CENPP-PL-CH

SUBJECT: W.O. 89-SHM-716, Report of Sediment Test Results

Project: WILLAMETTE RIVER - BURLINGTON NORTHERN R.R. BRIDGE  
Intended Used: ---  
Source of Material: Willamette River  
Submitted by: CENPP-PL-CH (Siipola)  
Date Sampled: --- Date Received: 20 Jul 89  
Method of Test or Specification: ASTM, EM1110-2-1906  
Reference: a) DA Form 2544, Order No. E86-89-0140, dated 27 Jun 89.  
b) NPD Form 300, Sample Transmittal dated 20 Jul 89, covering  
the samples tested.

## 1. Enclosed are:

a. Enclosure 1, one summary sheet, "Results of Physical Analyses of Sediment," with results for the five samples tested.

b. Enclosure 2, five gradation analysis summary sheets.

## 2. This completes all work to date.

Encls

JAMES A. PAXTON  
Director

  
paxton

Copy Furnished: CENPD-EN-G  
W.O. 89-SHM-716  
Soils Branch  
Reading File

TJS  
seeman

MFR: Routine testing on Willamette River sediment samples. All samples were sandy silts. Complete copy in office files.

CENPD-EN-G-L (89-BHM-716)

WILLAMETTE RIVER - BURLINGTON NORTHERN BRIDGE

## Results of Dredge Test Analysis

<u>CENPP Sample Number</u>	<u>Resuspended Density, gms/L</u>	<u>Void Ratio</u>	<u>Volatile Solids, %</u>	<u>Specific Gravity</u>	<u>Roundness Grading</u>
WRBN-1-1	1595	1.906	2.3	2.73	subangular to subround
WRBN-1-2	1690	1.531	1.2	2.75	angular to subangular
9N-2-1	1638	1.715	2.5	2.73	angular to subangular
WRBN-2-2	1660	1.648	1.5	2.75	angular to subangular

---

Received : 20 Jul 89



\*\*\* Corps of Engineers - North Pacific Division Materials Laboratory \*\*\*

WILLAMETTE RIVER - B.N.R.R. BRIDGE (89-SHM-716)

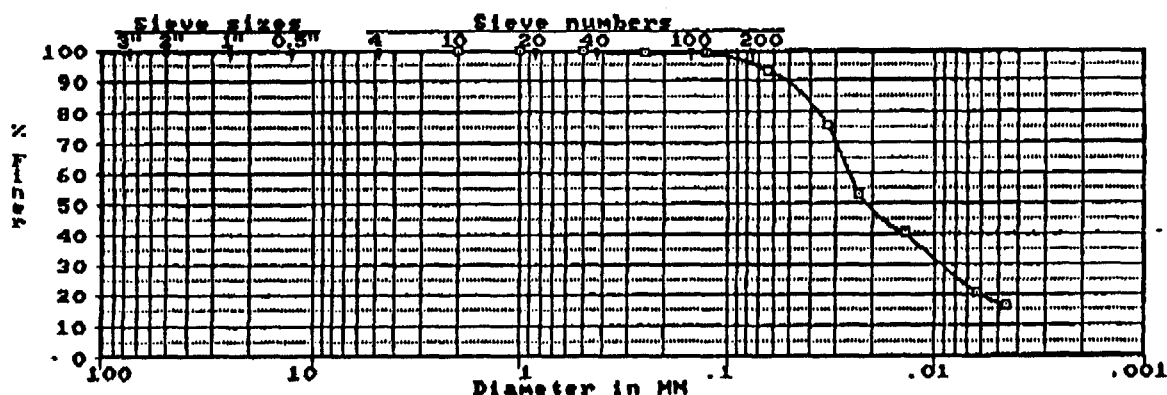
Boring: --- Sample: WRBN-1-1 Depth: 0-29" Lab No.: 71601

Sieve Analysis			Hydrometer Analysis				
Cumulative			Sample Weight: 83 gr.				
Sieve	Grams Retained	Percent Passing	Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
5 In.	0.00	100.0	1	20.0	63.0	0.0328	75.7
2.5 In.	0.00	100.0	3	20.0	44.0	0.0233	53.1
1.25 In.	0.00	100.0	10	20.0	33.5	0.0139	40.6
5/8 In.	0.00	100.0	100	20.0	17.0	0.0064	20.9
5/16 In.	0.00	100.0	200	20.0	13.0	0.0046	16.1
No. 5	0.00	100.0					
No. 10	0.00	100.0					
Pan	83.00	0.0					
No. 18	0.00	100.0					
No. 35	0.10	99.9					
No. 60	0.60	99.3					
No. 120	0.70	99.2					
No. 230	5.70	93.1					
Pan	83.00	0.0					

D85: .042 D60: .026 D50: .021 D30: .0094 mm  
Gravel: 0.0% Sand: 4.5% Fines: 95.5%

Comments

Cannot classify soil without knowing type of fines.



\*\*\* Corps of Engineers - North Pacific Division Materials Laboratory \*\*\*

WILLAMETTE RIVER - B.N.R.R. BRIDGE (89-SHM-716)

Boring: --- Sample: WRBN-1-2 Depth: 29-111" Lab No.: 71602

Sieve Analysis			Hydrometer Analysis				
Cumulative			Sample Weight: 67.2 gr. Start Time: 0000				
Sieve	Grams Retained	Percent Passing	Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
5 In.	0.00	100.0	1	20.0	40.0	0.0418	59.7
2.5 In.	0.00	100.0	3	20.0	26.0	0.0268	39.0
1.25 In.	0.00	100.0	10	20.0	15.0	0.0158	22.8
5/8 In.	0.00	100.0	100	20.0	8.0	0.0067	12.5
5/16 In.	0.00	100.0	200	20.0	5.5	0.0048	8.8
No. 5	0.00	100.0					
No. 10	0.00	100.0					
Pan	67.20	0.0					
No. 18	0.00	100.0					
No. 35	0.00	100.0					
No. 60	0.10	99.9					
No. 120	2.30	96.6					
No. 230	14.10	79.0					
Pan	67.20	0.0					

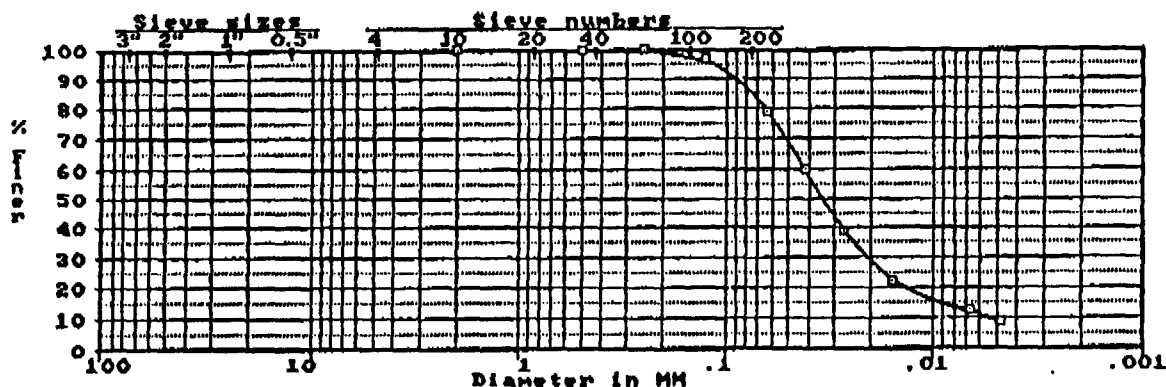
D85: .075 D60: .042 D50: .034 D30: .021 D15: .0091 D10: .0054 mm

Cu: 7.86 Cc: 1.90

Gravel: 0.0% Sand: 15.0% Fines: 85.0%

Comments

Cannot classify soil without knowing type of fines.



\*\*\* Corps of Engineers - North Pacific Division Materials Laboratory \*\*\*

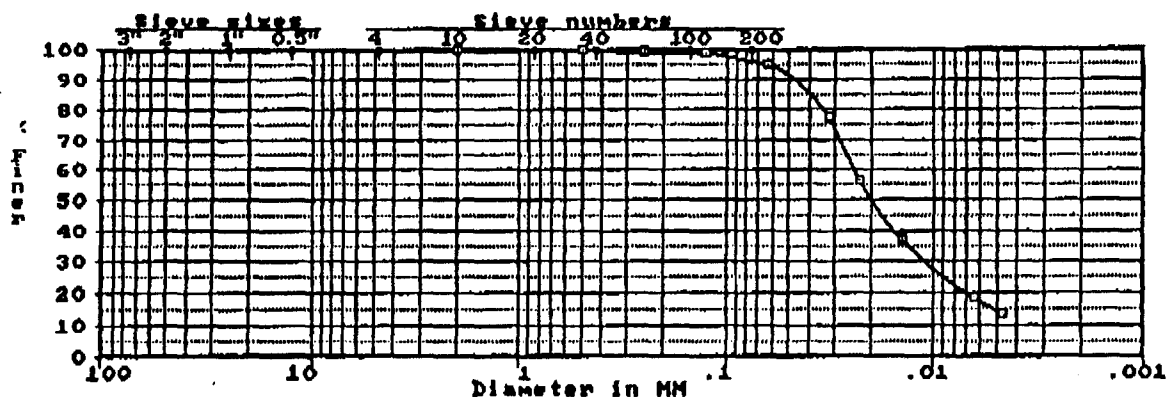
WILLAMETTE RIVER - B.N.R.R. BRIDGE (89-SHM-716)

Boring: --- Sample: WRBN-2-1 Depth: 0.5-37.5" Lab No.: 71603

Sieve Analysis			Hydrometer Analysis				
Cumulative			Sample Weight: 82.1 gr.		Start Time: 0000		
Sieve	Grams Retained	Percent Passing	Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
5 In.	0.00	100.0	1	20.0	64.0	0.0323	77.8
2.5 In.	0.00	100.0	3	20.0	46.0	0.0229	56.1
1.25 In.	0.00	100.0	10	20.0	30.6	0.0142	37.5
5/8 In.	0.00	100.0	100	20.0	15.0	0.0064	18.7
5/16 In.	0.00	100.0	200	20.0	11.0	0.0047	13.9
No. 5	0.00	100.0					
No. 10	0.00	100.0					
Pan	82.10	0.0					
No. 18	0.00	100.0					
No. 35	0.00	100.0					
No. 60	0.50	99.4					
No. 120	0.80	99.0					
No. 230	3.90	95.2					
Pan	82.10	0.0					

D85: .039 D60: .024 D50: .020 D30: .011 D15: .0051 mm  
Gravel: 0.0% Sand: 3.8% Fines: 96.2%

Comments  
Cannot classify soil without knowing type of fines.



## \* \* \* Corps of Engineers - North Pacific Division Materials Laboratory \* \* \*

WILLAMETTE RIVER - B.N.R.R. BRIDGE (89-SHM-716)

Boring: --- Sample: WRBN-2-2 Depth: 37.5-104" Lab No.: 71604

## ----- Sieve Analysis -----

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	0.00	100.0
Pan	84.00	0.0
No. 18	0.00	100.0
No. 35	0.10	99.9
No. 60	0.40	99.5
No. 120	5.40	93.6
No. 230	32.90	60.8
Pan	84.00	0.0

## ----- Hydrometer Analysis -----

Sample Weight: 84. gr.	Start Time: 0000			
Temp	Hydrometer	Diameter	Percent	
Time	(C)	Reading	in mm	Finer
1	20.0	35.0	0.0436	41.8
3	20.0	23.0	0.0274	27.7
10	20.0	14.0	0.0159	17.1
100	20.0	6.5	0.0068	8.2
200	20.0	5.5	0.0048	7.1

D85: 0.10 D60: .062 D50: .051 D30: .030 D15: .014 D10: .0088 mm

Cu: 7.05 Cc: 1.66

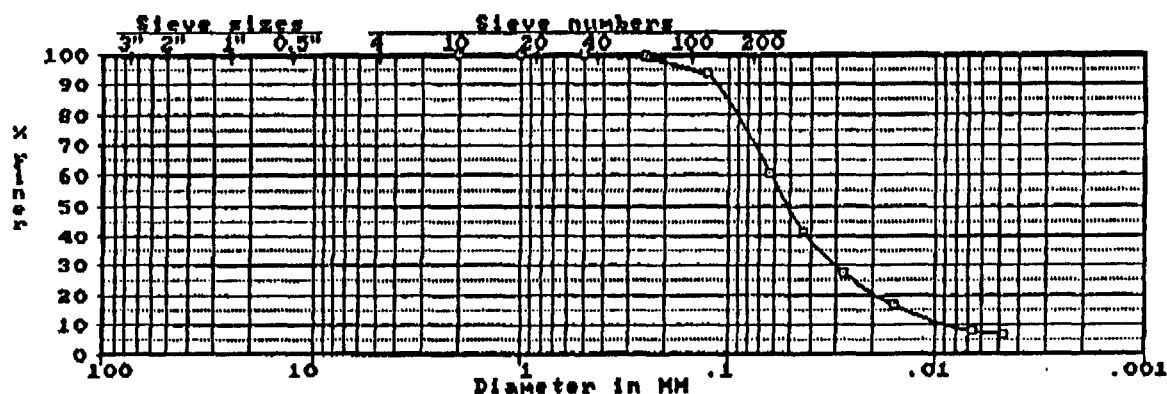
Gravel: 0.0%

Sand: 29.4%

Fines: 70.6%

## ----- Comments -----

Cannot classify soil without knowing type of fines.



\*\*\* Corps of Engineers - North Pacific Division Materials Laboratory \*\*\*

WILLAMETTE RIVER - B.N.R.R. BRIDGE (89-SHM-716)

Boring: --- Sample: WRBN-3 Depth: --- Lab No.: 71605

----- Sieve Analysis -----

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	5.10	99.7
No. 5	5.10	99.7
No. 10	6.20	99.7
Pan	1932.70	0.0
No. 18	0.50	99.4
No. 35	9.30	93.8
No. 60	118.50	24.8
No. 120	153.80	2.5
No. 230	155.80	1.3
Pan	157.80	0.0

No hydrometer analysis.

D85: 0.46 D60: 0.35 D50: 0.32 D30: 0.26 D15: 0.21 D10: 0.18 mm

Cu: 1.96 Cc: 1.09

Gravel: 0.3%

Sand: 98.1%

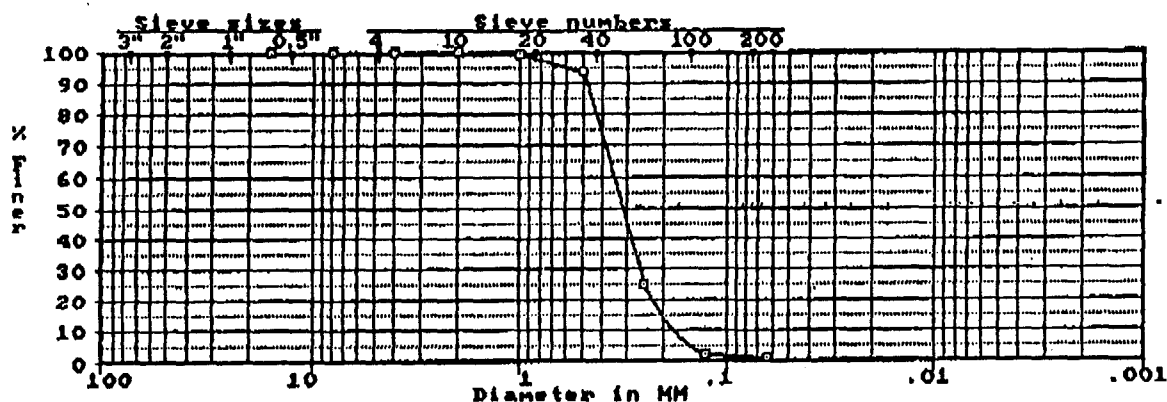
Fines: 1.6%

----- ASTM D 2487 Classification -----

SP Poorly graded SAND

----- Comments -----

DEPTH NOT GIVEN



**ATTACHMENT 3**



Pacific Northwest Division  
Marine Sciences Laboratory  
439 West Sequim Bay Road  
Sequim, Washington 98282  
(206) 683-4151

September 15, 1989

Mr. Mark Siipola  
U.S. Army Corps of Engineers  
P.O. Box 2946, Attn: PL-AP  
Portland, Oregon 97208

Dear Mark:

Recently Pacific Northwest Laboratory (Battelle-Northwest) conducted chemical analyses of sediments from the Portland District dredging project (Willamette River - Burlington Northern Railroad Bridge) collected by your organization. Battelle received, in good condition, on July 25, 1989, five sediment samples from the COE. These samples were analyzed for metals (Ag, As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn), phthalates, oil and grease, TOC, pesticides, PCBs, PAHs and phenols. The methods included:

Metal - By U.S. EPA (1986) Method 3050, which includes acid digestion followed by atomic absorption.

Oil and Grease - By Standard Methods 502 (1975), which includes solvent extraction and quantification by infrared spectrophotometry.

PAH, Phthalates, and Phenols - By U.S. EPA (1986) Method 8270, which includes solvent extraction and quantification by GC/MS.

TOC - By Standard Methods 502 (1975), which includes combustion of sediment and quantification by infrared absorption.

Pesticides and PCBs - By U.S. EPA (1986) Method 8080, which includes solvent extraction and quantification by GC-ECD.

Phenols - By U.S. EPA (1986) Method 8040 which includes solvent extraction and quantification by GC-FID.

For quality control (QC) surrogates were added to the sediments analyzed for organic compounds. The surrogate recoveries ranged from 67% to 98%.

Mr. Mark Siipola  
September 14, 1989  
Page 2

The chemical results in the enclosed tables indicate metals, TOC, and oil and grease concentrations are low and typical for uncontaminated sandy river sediment. Pesticides, PCBs, PAHs, phthalates and phenols are below the method of detection limit except for traces of bis(2-ethylhexyl)phthalate that is present at or near the detection limit in several samples.

If I can be of additional assistance to your organization, please call me at 206/683-4151.

Sincerely,



Eric Crecelius  
Senior Research Scientist

:at

Enclosures



Concentrations of Metals, Oil and Grease, and Total  
Organic Carbon in Willamette River Sediment  
(July 1989)

<u>Parameter</u>	<u>mg/kg dry weight</u>				
	<u>WRBN1-1</u>	<u>WRBN1-2</u>	<u>WRBN2-1</u>	<u>WRBN2-2</u>	<u>WRBN3</u>
Ag	0.113	0.071	0.087	0.060	0.026
As	13	14	23	15	11
Cd	0.41	0.15	0.08	0.13	0.080
Cr	23.0	17.3	25.3	14.2	17.5
Cu	28.7	22.3	31.0	19.0	16.3
Pb	13.3	13.2	16.6	5.0	2.6
Hg	0.03	0.03	0.03	0.02	0.02
Ni	20.8	17.2	23.4	14.9	20.4
Zn	87.7	72.9	87.1	65.2	50.2
Oil and Grease	<36	<37	<37	<36	----
Total Organic Carbon	< 0.1%	< 0.1%	< 0.1%	< 0.1%	----

## ORGANICS ANALYSIS DATA SHEET

## Semivolatiles by Methods 625/8270

Lab ID: 3358A  
Matrix: Soils/Sediments

Sample No: WRBN-1-1

QC Report No: 3358 - Batelle  
Project No: PO#60694AKS  
VTSR: 07/27/89

Date Release Authorized: *Kevin P. Selmer*  
Report prepared 08/18/89 MAC:B

Date extracted: 08/03/89  
Analyzed (FINN 4): 08/10/89  
GPC Clean-up: YES (1 of 2)

Sample Wt: 78.7 gm (Dry Weight)  
Percent Moisture: 29.6%  
pH: 8.7  
Conc/Dilution: 1 to 1

CAS Number		µg/Kg	CAS Number		µg/Kg
108-95-2	Phenol	50U	83-32-9	Acenaphthene	25U
111-44-4	bis(2-Chloroethyl)Ether	25U	51-28-5	2,4-Dinitrophenol	250U
95-57-8	2-Chlorophenol	25U	100-02-7	4-Nitrophenol	130U
541-73-1	1,3-Dichlorobenzene	25U	132-64-9	Dibenzofuran	25U
106-46-7	1,4-Dichlorobenzene	25U	121-14-2	2,4-Dinitrotoluene	130U
100-51-6	Benzyl Alcohol	130U	606-20-2	2,6-Dinitrotoluene	130U
95-50-1	1,2-Dichlorobenzene	25U	84-66-2	Diethylphthalate	25U
95-48-7	2-Methylphenol	25U	7005-72-3	4-Chlorophenyl-phenylether	25U
30638-32-9	bis(2-chloroisopropyl)Ether	25U	86-73-7	Fluorene	25U
44-5	4-Methylphenol	25U	100-01-6	4-Nitroaniline	130U
1-64-7	N-Nitroso-Di-n-Propylamine	25U	534-52-1	4,6-Dinitro-2-Methylphenol	250U
67-72-1	Hexachloroethane	50U	86-30-6	N-Nitrosodiphenylamine(1)	25U
98-95-3	Nitrobenzene	25U	101-55-3	4-Bromophenyl-phenylether	25U
78-59-1	Isophorone	25U	118-74-1	Hexachlorobenzene	25U
88-75-5	2-Nitrophenol	130U	87-86-5	Pentachlorophenol	130U
105-67-9	2,4-Dimethylphenol	50U	85-01-8	Phenanthrene	25U
65-85-0	Benzoic Acid	250U	120-12-7	Anthracene	25U
111-91-1	bis(2-Chloroethoxy)Methane	25U	84-74-2	Di-n-Butylphthalate	25U
120-83-2	2,4-Dichlorophenol	80U	206-44-0	Fluoranthene	25U
120-82-1	1,2,4-Trichlorobenzene	25U	129-00-0	Pyrene	25U
91-20-3	Naphthalene	25U	85-68-7	Butylbenzylphthalate	25U
106-47-8	4-Chloroaniline	80U	91-94-1	3,3'-Dichlorobenzidine	130U
87-68-3	Hexachlorobutadiene	50U	56-55-3	Benzo(a)Anthracene	25U
59-50-7	4-Chloro-3-Methylphenol	50U	117-81-7	bis(2-Ethylhexyl)Phthalate	12JB
91-57-6	2-Methylnaphthalene	25U	218-01-9	Chrysene	25U
77-47-4	Hexachlorocyclopentadiene	130U	117-84-0	Di-n-Octyl Phthalate	25U
88-06-2	2,4,6-Trichlorophenol	130U	205-99-2	Benzo(b)Fluoranthene	25U
95-95-4	2,4,5-Trichlorophenol	130U	207-08-9	Benzo(k)Fluoranthene	25U
91-58-7	2-Chloronaphthalene	25U	50-32-8	Benzo(a)Pyrene	25U
88-74-4	2-Nitroaniline	130U	193-39-5	Indeno(1,2,3-cd)Pyrene	25U
131-11-3	Dimethyl Phthalate	25U	53-70-3	Dibenz(a,h)Anthracene	25U
208-96-8	Acenaphthylene	25U	191-24-2	Benzo(ghi)Perylene	25U
209-2	3-Nitroaniline	130U			

(1) Cannot be separated from diphenylamine

## \*Base/neutral surrogate recoveries

d5-Nitrobenzene	86.9%
2-Fluorobiphenyl	75.5%
d14-p-Terphenyl	72.7%

## \*Acid surrogate recoveries

d5-Phenol	98.2%
2-Fluorophenol	76.6%
2,4,6-Tribromophenol	97.5%

## ORGANICS ANALYSIS DATA SHEET

## Semivolatiles by Methods 625/8270

Lab ID: 3358B  
Matrix: Soils/Sediments

Sample No: WRBN-1-2

QC Report No: 3358 - Batelle  
Project No: PO#60694AKS  
VTSR: 07/27/89

Date Release Authorized: John J. Eide  
Report prepared 08/18/89 MAC:B

Date extracted: 08/03/89  
Analyzed (FINN 4): 08/10/89  
GPC Clean-up: YES (1 of 2)

Sample Wt: 97.3 gm (Dry Weight)  
Percent Moisture: 27.3%  
pH: 8.7  
Conc/Dilution: 1 to 1

CAS Number		µg/Kg	CAS Number		µg/Kg
108-95-2	Phenol	40U	83-32-9	Acenaphthene	21U
111-44-4	bis(2-Chloroethyl)Ether	21U	51-28-5	2,4-Dinitrophenol	210U
95-57-8	2-Chlorophenol	21U	100-02-7	4-Nitrophenol	100U
541-73-1	1,3-Dichlorobenzene	21U	132-64-9	Dibenzofuran	21U
106-46-7	1,4-Dichlorobenzene	21U	121-14-2	2,4-Dinitrotoluene	100U
100-51-6	Benzyl Alcohol	100U	606-20-2	2,6-Dinitrotoluene	100U
95-50-1	1,2-Dichlorobenzene	21U	84-66-2	Diethylphthalate	21U
95-48-7	2-Methylphenol	21U	7005-72-3	4-Chlorophenyl-phenylether	21U
39638-32-9	bis(2-chloroisopropyl)Ether	21U	86-73-7	Fluorene	21U
44-5	4-Methylphenol	21U	100-01-6	4-Nitroaniline	100U
64-7	N-Nitroso-Di-n-Propylamine	21U	534-52-1	4,6-Dinitro-2-Methylphenol	210U
67-72-1	Hexachloroethane	40U	86-30-6	N-Nitrosodiphenylamine(1)	21U
98-95-3	Nitrobenzene	21U	101-55-3	4-Bromophenyl-phenylether	21U
78-59-1	Isophorone	21U	118-74-1	Hexachlorobenzene	21U
88-75-5	2-Nitrophenol	100U	87-86-5	Pentachlorophenol	100U
105-67-9	2,4-Dimethylphenol	40U	85-01-8	Phenanthrene	21U
65-85-0	Benzoic Acid	210U	120-12-7	Anthracene	21U
111-91-1	bis(2-Chloroethoxy)Methane	21U	84-74-2	Di-n-Butylphthalate	21U
120-83-2	2,4-Dichlorophenol	60U	206-44-0	Fluoranthene	21U
120-82-1	1,2,4-Trichlorobenzene	21U	129-00-0	Pyrene	21U
91-20-3	Naphthalene	21U	85-68-7	Butylbenzylphthalate	21U
106-47-8	4-Chloroaniline	60U	91-94-1	3,3'-Dichlorobenzidine	100U
87-68-3	Hexachlorobutadiene	40U	56-55-3	Benzo(a)Anthracene	21U
59-50-7	4-Chloro-3-Methylphenol	40U	117-81-7	bis(2-Ethylhexyl)Phthalate	6JB
91-57-6	2-Methylnaphthalene	21U	218-01-9	Chrysene	21U
77-47-4	Hexachlorocyclopentadiene	100U	117-84-0	Di-n-Octyl Phthalate	21U
88-06-2	2,4,6-Trichlorophenol	100U	205-99-2	Benzo(b)Fluoranthene	21U
95-95-4	2,4,5-Trichlorophenol	100U	207-08-9	Benzo(k)Fluoranthene	21U
91-58-7	2-Chloronaphthalene	21U	50-32-8	Benzo(a)Pyrene	21U
88-74-4	2-Nitroaniline	100U	193-39-5	Indeno(1,2,3-cd)Pyrene	21U
131-11-3	Dimethyl Phthalate	21U	53-70-3	Dibenz(a,h)Anthracene	21U
208-96-8	Acenaphthylene	21U	191-24-2	Benzo(ghi)Perylene	21U
89-09-2	3-Nitroaniline	100U			

(1) Cannot be separated from diphenylamine

## \*Base/neutral surrogate recoveries

d5-Nitrobenzene	87.9%
2-Fluorobiphenyl	80.8%
d14-p-Terphenyl	69.1%

## \*Acid surrogate recoveries

d5-Phenol	98.2%
2-Fluorophenol	72.8%
2,4,6-Tribromophenol	95.4%

# ORGANICS ANALYSIS DATA SHEET - PESTICIDE/PCB

Lab Sample ID: 3358 A  
Matrix: Soil  
VTSR: 07/27/89

Date Extracted: 08/03/89  
Date Analyzed: 08/15/89  
Conc/Dil Factor: 1:20  
Dry Weight: 78.70 g

Sample No.: WRBN1-1  
QC Report No.: 3358-Battelle  
Project: #60694AKS

GPC Cleanup: Yes  
Alumina Cleanup: Yes  
Sulfur Cleanup: No

Data Release Authorized: *John M. Kepler*

DATA PREPARED: MAC:C C.G. (08/16/89)

CAS Number		µg/kg
319-84-6	Alpha-BHC	0.7 U
319-85-7	Beta-BHC	0.7 U
319-86-8	Delta-BHC	1.0 U
58-89-9	Gamma-BHC (Lindane)	0.7 U
76-44-8	Heptachlor	0.7 U
309-00-2	Aldrin	0.7 U
1024-57-3	Heptachlor Epoxide	0.7 U
959-98-8	Endosulfan I	0.7 U
60-57-1	Dieldrin	1.5 U
72-55-9	4,4'-DDE	1.5 U
72-20-8	Endrin	1.5 U
33212-65-9	Endosulfan II	1.5 U
72-54-8	4,4'-DDD	2.0 U
1031-07-8	Endosulfan Sulfate	3.0 U
50-29-3	4,4'-DDT	2.0 U
72-43-5	Methoxychlor	3.0 U
53494-70-5	Endrin Ketone	2.0 U
5103-74-2	Gamma-Chlordane	1.0 U
5103-71-9	Alpha-Chlordane	1.0 U
8001-35-2	Toxaphene	100 U
-	Aroclor-1242/1016	14 U
12672-29-6	Aroclor-1248	14 U
11097-69-1	Aroclor-1254	14 U
11096-82-5	Aroclor-1260	14 U

## \* Pesticide Surrogate Recovery

Dibutylchlorodate	76%
-------------------	-----

## Data Qualifiers

- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when the result is less than the calculated detection limit.

# ORGANICS ANALYSIS DATA SHEET - PESTICIDE/PCB

Lab Sample ID: 3358 B  
Matrix: Soil  
VTSR: 07/27/89

Date Extracted: 08/03/89  
Date Analyzed: 08/15/89  
Conc/Dil Factor: 1:20  
Dry Weight: 97.30 g

Sample No.: WRBN1-2  
QC Report No.: 3358-Battelle  
Project: #60694AKS

GPC Cleanup: Yes  
Alumina Cleanup: Yes  
Sulfur Cleanup: No

Data Release Authorized: *Peter M. Kepler*  
DATA PREPARED: MAC:C C.G. (08/16/89)

CAS Number		ug/kg
319-84-6	Alpha-BHC	0.7 U
319-85-7	Beta-BHC	0.7 U
319-86-8	Delta-BHC	1.0 U
58-89-9	Gamma-BHC (Lindane)	0.7 U
76-44-8	Heptachlor	0.7 U
309-00-2	Aldrin	0.7 U
1024-57-3	Heptachlor Epoxide	0.7 U
959-98-8	Endosulfan I	0.7 U
60-57-1	Dieldrin	1.5 U
72-55-9	4,4'-DDE	1.5 U
72-20-8	Endrin	1.5 U
33212-65-9	Endosulfan II	1.5 U
72-54-8	4,4'-DDD	2.0 U
1031-07-8	Endosulfan Sulfate	3.0 U
50-29-3	4,4'-DDT	2.0 U
72-43-5	Methoxychlor	3.0 U
53494-70-5	Endrin Ketone	2.0 U
5103-74-2	Gamma-Chlordane	1.0 U
5103-71-9	Alpha-Chlordane	1.0 U
8001-35-2	Toxaphene	100 U
-	Aroclor-1242/1016	14 U
12672-29-6	Aroclor-1248	14 U
11097-69-1	Aroclor-1254	14 U
11096-82-5	Aroclor-1260	14 U

## \* Pesticide Surrogate Recovery

Dibutylchlorendate	76%
--------------------	-----

## Data Qualifiers

- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when the result is less than the calculated detection limit.

# ORGANICS ANALYSIS DATA SHEET - PESTICIDE/PCB

Lab Sample ID: 3358 C  
Matrix: Soil  
VTSR: 07/27/89

Date Extracted: 08/03/89  
Date Analyzed: 08/15/89  
Conc/Dil Factor: 1:20  
Dry Weight: 89.50 g

Sample No.: WRBN2-1  
QC Report No.: 3358-Battelle  
Project: #60694AKS

GPC Cleanup: Yes  
Alumina Cleanup: Yes  
Sulfur Cleanup: No

Data Release Authorized: *Peter M. Keph*  
DATA PREPARED: MAC:C C.G. (08/16/89)

CAS Number		ug/kg
319-84-6	Alpha-BHC	0.7 U
319-85-7	Beta-BHC	0.7 U
319-86-8	Delta-BHC	1.0 U
58-89-9	Gamma-BHC (Lindane)	0.7 U
76-44-8	Heptachlor	0.7 U
309-00-2	Aldrin	0.7 U
1024-57-3	Heptachlor Epoxide	0.7 U
959-98-8	Endosulfan I	0.7 U
60-57-1	Dieldrin	1.5 U
72-55-9	4,4'-DDE	1.5 U
72-20-8	Endrin	1.5 U
33212-65-9	Endosulfan II	1.5 U
72-54-8	4,4'-DDD	2.0 U
1031-07-8	Endosulfan Sulfate	3.0 U
50-29-3	4,4'-DDT	2.0 U
72-43-5	Methoxychlor	3.0 U
53494-70-5	Endrin Ketone	2.0 U
5103-74-2	Gamma-Chlordane	1.0 U
5103-71-9	Alpha-Chlordane	1.0 U
8001-35-2	Toxaphene	100 U
-	Aroclor-1242/1016	14 U
12672-29-6	Aroclor-1248	14 U
11097-69-1	Aroclor-1254	14 U
11096-82-5	Aroclor-1260	14 U

## \* Pesticide Surrogate Recovery

Dibutylchlorodate	88%
-------------------	-----

## Data Qualifiers

- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when the result is less than the calculated detection limit.

# ORGANICS ANALYSIS DATA SHEET - PESTICIDE/PCB

Lab Sample ID: 3358 D  
Matrix: Soil  
VTSR: 07/27/89

Date Extracted: 08/03/89  
Date Analyzed: 08/15/89  
Conc/Dil Factor: 1:20  
Dry Weight: 91.30 g

Sample No.: WRBN2-2  
QC Report No.: 3358-Battelle  
Project: #60694AKS

GPC Cleanup: Yes  
Alumina Cleanup: Yes  
Sulfur Cleanup: No

Data Release Authorized: *Peter M. Hughes*

DATA PREPARED: MAC:C C.G. (08/16/89)

CAS Number		ug/kg
319-84-6	Alpha-BHC	0.7 U
319-85-7	Beta-BHC	0.7 U
319-86-8	Delta-BHC	1.0 U
58-89-9	Gamma-BHC (Lindane)	0.7 U
76-44-8	Heptachlor	0.7 U
309-00-2	Aldrin	0.7 U
1024-57-3	Heptachlor Epoxide	0.7 U
959-98-8	Endosulfan I	0.7 U
60-57-1	Dieldrin	1.5 U
72-55-9	4,4'-DDE	1.5 U
72-20-8	Endrin	1.5 U
33212-65-9	Endosulfan II	1.5 U
72-54-8	4,4'-DDD	2.0 U
1031-07-8	Endosulfan Sulfate	3.0 U
50-29-3	4,4'-DDT	2.0 U
72-43-5	Methoxychlor	3.0 U
53494-70-5	Endrin Ketone	2.0 U
5103-74-2	Gamma-Chlordane	1.0 U
5103-71-9	Alpha-Chlordane	1.0 U
8001-35-2	Toxaphene	100 U
-	Aroclor-1242/1016	14 U
12672-29-6	Aroclor-1248	14 U
11097-69-1	Aroclor-1254	14 U
11096-82-5	Aroclor-1260	14 U

## \* Pesticide Surrogate Recovery

Dibutylchlorodate	82%
-------------------	-----

## Data Qualifiers

- U Indicates compound was analyzed for but not detected at the given detection limit.
- J Indicates an estimated value when the result is less than the calculated detection limit.

## ORGANICS ANALYSIS DATA SHEET

Semivolatiles by Methods 625/8270

Lab ID: 3358C

Matrix: Soils/Sediments

Sample No: WRBN-2-1

QC Report No: 3358 - Batelle

Project No: PO#60694AKS

VTSR: 07/27/89

Date Release Authorized: Don A. Loh

Report prepared 08/18/89 MAC:B

Date extracted: 08/03/89

Analyzed (FINN 4): 08/10/89

GPC Clean-up: YES (1 of 2)

Sample Wt: 89.5 gm (Dry Weight)

Percent Moisture: 29.1%

pH: 8.5

Conc/Dilution: 1 to 1

CAS Number		µg/Kg
108-95-2	Phenol	40U
111-44-4	bis(2-Chloroethyl)Ether	22U
95-57-8	2-Chlorophenol	22U
541-73-1	1,3-Dichlorobenzene	22U
106-46-7	1,4-Dichlorobenzene	22U
100-51-6	Benzyl Alcohol	110U
95-50-1	1,2-Dichlorobenzene	22U
95-48-7	2-Methylphenol	22U
39638-32-9	bis(2-chloroisopropyl)Ether	22U
44-5	4-Methylphenol	22U
64-7	N-Nitroso-Di-n-Propylamine	22U
67-72-1	Hexachloroethane	40U
98-95-3	Nitrobenzene	22U
78-59-1	Isophorone	22U
88-75-5	2-Nitrophenol	110U
105-67-9	2,4-Dimethylphenol	40U
65-85-0	Benzoic Acid	220U
111-91-1	bis(2-Chloroethoxy)Methane	22U
120-83-2	2,4-Dichlorophenol	70U
120-82-1	1,2,4-Trichlorobenzene	22U
91-20-3	Naphthalene	22U
106-47-8	4-Chloroaniline	70U
87-68-3	Hexachlorobutadiene	40U
59-50-7	4-Chloro-3-Methylphenol	40U
91-57-6	2-Methylnaphthalene	22U
77-47-4	Hexachlorocyclopentadiene	110U
88-06-2	2,4,6-Trichlorophenol	110U
95-95-4	2,4,5-Trichlorophenol	110U
91-58-7	2-Chloronaphthalene	22U
88-74-4	2-Nitroaniline	110U
131-11-3	Dimethyl Phthalate	22U
208-96-8	Acenaphthylene	22U
99-09-2	3-Nitroaniline	110U

CAS Number		µg/Kg
83-32-9	Acenaphthene	22U
51-28-5	2,4-Dinitrophenol	220U
100-02-7	4-Nitrophenol	110U
132-64-9	Dibenzofuran	22U
121-14-2	2,4-Dinitrotoluene	110U
606-20-2	2,6-Dinitrotoluene	110U
84-66-2	Diethylphthalate	22U
7005-72-3	4-Chlorophenyl-phenylether	22U
86-73-7	Fluorene	22U
100-01-6	4-Nitroaniline	110U
534-52-1	4,6-Dinitro-2-Methylphenol	220U
86-30-6	N-Nitrosodiphenylamine(1)	22U
101-55-3	4-Bromophenyl-phenylether	22U
118-74-1	Hexachlorobenzene	22U
87-86-5	Pentachlorophenol	110U
85-01-8	Phenanthrene	22U
120-12-7	Anthracene	22U
84-74-2	Di-n-Butylphthalate	22U
206-44-0	Fluoranthene	22U
129-00-0	Pyrene	22U
85-68-7	Butylbenzylphthalate	22U
91-94-1	3,3'-Dichlorobenzidine	110U
56-55-3	Benzo(a)Anthracene	22U
117-81-7	bis(2-Ethylhexyl)Phthalate	6JB
218-01-9	Chrysene	22U
117-84-0	Di-n-Octyl Phthalate	22U
205-99-2	Benzo(b)Fluoranthene	22U
207-08-9	Benzo(k)Fluoranthene	22U
50-32-8	Benzo(a)Pyrene	22U
193-39-5	Indeno(1,2,3-cd)Pyrene	22U
53-70-3	Dibenz(a,h)Anthracene	22U
191-24-2	Benzo(ghi)Perylene	22U

(1) Cannot be separated from diphenylamine

## \*Base/neutral surrogate recoveries

d5-Nitrobenzene	98.2%
2-Fluorobiphenyl	77.8%
d14-p-Terphenyl	64.7%

## \*Acid surrogate recoveries

d5-Phenol	93.0%
2-Fluorophenol	74.9%
2,4,6-Tribromophenol	89.9%



## ORGANICS ANALYSIS DATA SHEET

Semivolatiles by Methods 625/8270

Lab ID: 3358D  
Matrix: Soils/Sediments

Sample No: WRBN-2-2

QC Report No: 3358 - Batelle  
Project No: PO#60694AKS  
VTSR: 07/27/89Date Release Authorized: James H. [Signature]  
Report prepared 08/18/89 MAC:BDate extracted: 08/03/89  
Analyzed (FINN 4): 08/10/89  
GPC Clean-up: YES (1 of 2)Sample Wt: 91.3 gm (Dry Weight)  
Percent Moisture: 26.1%  
pH: 8.1  
Conc/Dilution: 1 to 1

CAS Number		µg/Kg	CAS Number		µg/Kg
108-95-2	Phenol	40U	83-32-9	Acenaphthene	22U
111-44-4	bis(2-Chloroethyl)Ether	22U	51-28-5	2,4-Dinitrophenol	220U
95-57-8	2-Chlorophenol	22U	100-02-7	4-Nitrophenol	110U
541-73-1	1,3-Dichlorobenzene	22U	132-64-9	Dibenzofuran	22U
106-46-7	1,4-Dichlorobenzene	22U	121-14-2	2,4-Dinitrotoluene	110U
100-51-6	Benzyl Alcohol	110U	606-20-2	2,6-Dinitrotoluene	110U
95-50-1	1,2-Dichlorobenzene	22U	84-66-2	Diethylphthalate	22U
95-48-7	2-Methylphenol	22U	7005-72-3	4-Chlorophenyl-phenylether	22U
338-32-9	bis(2-chloroisopropyl)Ether	22U	86-73-7	Fluorene	22U
44-5	4-Methylphenol	22U	100-01-6	4-Nitroaniline	110U
521-64-7	N-Nitroso-Di-n-Propylamine	22U	534-52-1	4,6-Dinitro-2-Methylphenol	220U
67-72-1	Hexachloroethane	40U	86-30-6	N-Nitrosodiphenylamine(1)	22U
98-95-3	Nitrobenzene	22U	101-55-3	4-Bromophenyl-phenylether	22U
78-59-1	Isophorone	22U	118-74-1	Hexachlorobenzene	22U
88-75-5	2-Nitrophenol	110U	87-86-5	Pentachlorophenol	110U
105-67-9	2,4-Dimethylphenol	40U	85-01-8	Phenanthrene	22U
65-85-0	Benzoic Acid	220U	120-12-7	Anthracene	22U
111-91-1	bis(2-Chloroethoxy)Methane	22U	84-74-2	Di-n-Butylphthalate	22U
120-83-2	2,4-Dichlorophenol	70U	206-44-0	Fluoranthene	22U
120-82-1	1,2,4-Trichlorobenzene	22U	129-00-0	Pyrene	22U
91-20-3	Naphthalene	22U	85-68-7	Butylbenzylphthalate	22U
106-47-8	4-Chloroaniline	70U	91-94-1	3,3'-Dichlorobenzidine	110U
87-68-3	Hexachlorobutadiene	40U	56-55-3	Benzo(a)Anthracene	22U
59-50-7	4-Chloro-3-Methylphenol	40U	117-81-7	bis(2-Ethylhexyl)Phthalate	22U
91-57-6	2-Methylnaphthalene	22U	218-01-9	Chrysene	22U
77-47-4	Hexachlorocyclopentadiene	110U	117-84-0	Di-n-Octyl Phthalate	22U
88-06-2	2,4,6-Trichlorophenol	110U	205-99-2	Benzo(b)Fluoranthene	22U
95-95-4	2,4,5-Trichlorophenol	110U	207-08-9	Benzo(k)Fluoranthene	22U
91-58-7	2-Chloronaphthalene	22U	50-32-8	Benzo(a)Pyrene	22U
88-74-4	2-Nitroaniline	110U	193-39-5	Indeno(1,2,3-cd)Pyrene	22U
131-11-3	Dimethyl Phthalate	22U	53-70-3	Dibenz(a,h)Anthracene	22U
208-96-8	Acenaphthylene	22U	191-24-2	Benzo(ghi)Perylene	22U
209-2	3-Nitroaniline	110U			

(1) Cannot be separated from diphenylamine

## \*Base/neutral surrogate recoveries

d5-Nitrobenzene	82.5%
2-Fluorobiphenyl	76.3%
d14-p-Terphenyl	66.6%

## \*Acid surrogate recoveries

d5-Phenol	94.0%
2-Fluorophenol	77.4%
2,4,6-Tribromophenol	88.8%